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Feeding ecology of *Tadarida aegyptiaca thomasi* in the Indian desert

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Abstract

Studied the Egyptian free-tailed bat, *Tadarida aegyptiaca thomasi,* collected from various districts of Rajasthan. It is primarily an insectivorous species. Coleoptera, Lepidoptera, Orthoptera, Hymenoptera and Diptera are preferred in all main four seasons, while termites are consumed in all except winter season. Occurrence of ground dwelling insects, caterpillars, spiders, larger bodied insects and water beetles in stomachs have been discussed in light of morpho-ethological adaptations of species. Presence of bat's own fur in stomach coincides with the breeding season of the species. Presence of various polyphagous insect pest species of crops in feeding menu of bats show that this species can play a promising role in biological management of harmful insects.

Introduction

The Egyptian free-tailed bat or Wrinkle-lipped bat, *Tadarida aegyptiaca thomasi* Wroughton (Chiroptera, Molossidae) is one of the most abundant species in Rajasthan which is part of the Great Indian Thar Desert (24.5–30.5° N : 60–70° E). Associated with warmer arid and semi-arid regions, of which it is well adapted both ecologically as well as

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physiologically, this species is not found in mountainous nor well-wooded regions. In its diurnal roost it is highly selective, favouring natural rock fissures or crevices in human settlement environment.

In spite of the occurrence of this species in abundance, except some reports (Advani and Vazirani 1981; Sinha and Advani 1976), little is known about the ecology, biology and ethology of this species. To fill up this gap, the present studies were undertaken to investigate the food composition and seasonal variation in the feeding pattern of this species as this aspect has been dealt in detail in respect of temperate bats but little is known regarding tropical species and particularly the Indian ones.

Methods

The bats were collected during various periodical faunistic surveys conducted by Desert Regional Station, Zoological Survey of India, Jodhpur from 1975 to 1977. Collections were made mainly from nine districts – Jodhpur, Boondi, Dungarpur, Jhalawar, Sawai Madhopur, Tonk, Ajmer, Banswara and Kota, well distributed in the arid and semi-arid parts of Rajasthan. In all 156 individuals were collected and examined. For each season, the break up of the sample size (N) is shown in the Table. After anaesthesia bats were dissected and their alimentary canals were cut open. The stomach contents were taken out with the help of brush and small forceps and then dried on filter paper at room temperature. After sorting, stomach items (insects etc.) were identified to the lowest taxonomic level feasible (Order-Family), through aid of microscope and later weighed on the balance to calculate their percent occurrence in the stomach contents, following Murton et al. (1964).

The seasonal fluctuations in the feeding pattern were determined by pooling data among four main seasons occurring in the Indian desert.

Results

The examination and analysis of the stomach contents reveal that the Egyptian free-tailed or Wrinkle-lipped bat, *T. aegyptiaca thomasi* is a primarily insectivorous species though some traces of plant material were also observed during monsoon and postmonsoon seasons (see table). Fur (tuft of hairs) of the same bat species occurred in larger proportions during summer and monsoon, whereas, it was present in traces during postmonsoon and winter. There were no remains of other animals except insects and some spiders in the stomachs, to be considered as food items.

In the winter season, December to February in the desert, when the temperature goes down to even – 5 °C, this species mainly banks upon Coleoptera (34.7 percent) followed by Orthoptera, Hymenoptera and Diptera in about equal proportions (see Table). Araneida (spiders) also record their occurrence in stomachs in moderate numbers in winter.

In the summer season, when the air temperature shoots up to even 50 °C, there is an increase in coleopteran diet by about 5.5 percent from winter to summer. However, percent frequency of Hymenoptera and Diptera decreases significantly. The bats devour upon an equal diet of Orthoptera (grasshoppers, crickets) during this season. Isoptera (termites) and Odonata (dragon and damselflies) also feature in the diet composition, though in low percent frequency.

During monsoon rainy months, there is sudden rise in the consumption of winged termites (*Microtermes obesii*, *Odontotermes obessus*, *Anacanthotermes* sp.) about four times (24.5 percent) to that of preceding summer season. Proportion of beetles declines to about half, while that of Hymenoptera and Lepidoptera increases in varied percentages. Dependence of Orthopteran diet is also lowered during monsoon.

The post monsoon season witnesses decrease in consumption of termites from 24.5 to 5.2 percent of the total diet. Other orders like Odonata and Dictyoptera again record their occurrence in stomachs, while there is three fold increase in the dipteran diet. Preference for Coleoptera almost remains at a same frequency of the monsoon season, whereas, moths are consumed in lower proportions.

Discussion

The Egyptian free tailed bat, *T. a. thomasi* is an anthrophilic species, being found in the close vicinity or in the midst of human environment at a tune of 100 percent of its total collection in western desert biome (Advani 1981a) and 91.3 percent in the southern parts of Rajasthan (Advani 1981b). Its roosting habitat has certainly an impact on its feeding behaviour particularly in deciding composition and relative occurrence of various insect

Table

Stomach contents of Egyptian free-tailed bat during four main seasons in Rajasthan desert

(expressed in per cent of total mass)

Stomach item	Seasons Winter (Dec.-Feb.) N=32	Summer (Mar.-June) N=41	Monsoon (rainy) (Jul.-Sept.) N=40	Post-monsoon (Oct.-Nov.) N=43
Coleoptera				
Scarabaeidae	11.2	6.4	8.5	6.1
Carabidae	13.4	10.2	–	12.5
Curculionidae	6.8	10.2	1.2	–
Bostrichidae	2.1	6.8	7.0	–
Dytiscidae	–	2.4	–	3.0
Unidentified	1.2	4.2	3.2	5.9
Lepidoptera				
Noctuidae	2.3	4.4	6.2	4.4
Arctiidae	6.6	9.3	7.8	7.2
Hymenoptera				
Formicidae	10.2	5.3	8.8	4.2
Vespidae	3.8	–	8.9	16.7
Neuroptera				
Mantispidae	4.5	–	1.2	2.2
Diptera				
Chironomidae	4.3	–	–	1.1
Culicidae	6.2	1.2	2.1	4.2
Unidentified	2.9	3.3	–	1.2
Orthoptera				
Gryllidae	14.0	16.2	3.9	7.9
Acrididae	3.2	1.2	5.3	3.8
Isoptera				
Termitidae	–	6.5	24.5	5.2
Odonata				
Libellulidae	–	1.2	–	6.4
Dictyoptera	2.2	4.0	–	3.9
Caterpillars of Lepidoptera (unidentified)	–	–	2.0	–
Araneida	4.0	–	–	1.0
Plant parts	–	–	1.3	1.0
Bat's own fur (tuft of hairs)	1.1	7.2	8.1	2.1

orders, like Diptera, Coleoptera, Dictyoptera and Hymenoptera in its stomach contents (see Table) in sufficient proportions. However, it appears that feeding habits of this species are also probably a combination of opportunism and selective predation, varying with local conditions such as the relative abundance of different kinds of insect preys. Occurrence of traces of plant parts in the stomachs of bats during monsoon and post monsoon is perhaps due to the remains of the undigested gut contents of insects eaten by bats. The presence of orthopterans, caterpillars of Lepidoptera, spiders and some ground beetles suggests that this species fed by picking these items from the ground or other surfaces rather than by aerial pursuit of prey. Moreover, its predation upon the larger sized insects like carabids, gryllids and dictyopterans is also an unique feature of the feeding habits of this species. These findings are in accordance with the general morphology of *Tadarida* bats, of having the wrinkled lips to facilitate a wider gap, broad wings and strong hind legs in comparison to other insectivorous bat species.

Feeding habits of *T. aegyptiaca* markedly differ from those of the Indian false vampire, *Megaderma lyra lyra* which depends upon an equal proportion of insect as well as the vertebrate animal diet (Advani 1981c) on an annual basis.

Seasonwise, during winter when the temperature slides down to about – 5 °C in desert, and the bats are relatively inactive, they thrive upon insects available in their near vicinity or home ranges, like mosquitoes, flies, house crickets, cockroaches, small beetles etc. In this season bats can also subsist upon their own fat reserves which they accumulate after the monsoon season. During summer and monsoon months preference for termites is quite obvious, as this period coincides with emergence of winged, soft bodied termites after first few showers (from mid June onwards) in the desert, likewise, in postmonsoon season occurrence of winged ants and wasps, dipteran flies, dragon flies determine the diet composition of this species.

The occurrence of bats' own fur (tuft of hairs) in stomachs in highest percent frequency during summer and then in monsoon in the stomachs, is explainable on the grounds that the peak of the breeding season of *T. aegyptiaca* occurs from June to September (Sinha and Advani 1976) in the Rajasthan desert, when the inter and intra sexual fights and other interactions like allogrooming are quite expected.

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Zusammenfassung

Nahrungsökologie von Tadarida aegyptiaca thomasi aus der indischen Wüste

Fledermäuse der Art *Tadarida aegyptiaca thomasi* wurden zu unterschiedlichen Jahreszeiten und in verschiedenen Bezirken von Rajasthan (NW-Indien) gefangen. Untersuchungen der Mageninhalte ergaben, daß die Tiere sich in allen vier Jahreszeiten hauptsächlich von Coleopteren, Lepidopteren, Orthopteren, Hymenopteren und Dipteren ernähren. Termiten werden nur während der Wintermonate nicht aufgenommen. Der Nachweis von bodenlebenden Insekten, Raupen, Spinnen und Wasserkäfern in den Mägen der Fledermäuse deutet darauf hin, daß *T. a. thomasi* Nahrung nicht nur im freien Flug erbeutet. Ferner machten im Sommer und Monsum Fledermaushaare einen relativ großen Anteil am Mageninhalt aus. Dieses stimmt überein mit der Zeit der Paarung und Jungenaufzucht von Juni bis September.

Die polyphage Ernährungsweise von *Tadarida aegyptiaca thomasi* unterstreicht die Bedeutung dieser Art für die Regulation von Schadinsektenpopulationen in landwirtschaftlichen Kulturen.

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Movement, home range and clustering in the European hare (*Lepus europaeus* Pallas) in The Netherlands

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Abstract

To examine aspects of dispersion in hares, data about movements and home range were collected from recoveries of tagged individuals as well as from radio-tracked animals. Most hares moved less than 500 m from the capture place, even the sucklings, and the mean home range size observed was 29 ha, showing a sedentary way of life. Displaced hares mostly could establish themselves near the place of release, and a low degree of agonistic behaviour to an introduced tame conspecific was observed.

Home ranges overlapped considerably, and at night clustering was observed. While in the twilight hares grazing gregariously showed less attentive interruptions compared with hares grazing solitarily, anti-predation behaviour was thought a function of clustering.

As from literature is known that under circumstances with poor food supply, such as in desert and in areas with deep snow cover, hares become more territorial during the reproduction season and more migratory in the winter, the results suggest that in our study areas food was not in short supply, presumably due to a high hunting pressure in autumn.

Introduction

Although in South-East Europe, after periods with heavy snow, groups of hundreds of roaming hares have been observed (Angermann 1973), roaming over large distances seems the exception in this species. Data collected by Andersen (1951), Rieck (1953, 1955), Szederjei (1959), Douglas (1970) and Pielowski (1972) showed that about 80 percent of tagged animals released on their capture place, were recovered within a distance of 3 km, and less than 10 percent were found more than 5 km away. Rieck (1953) calculated from his recoveries of tagged hares that the home range rarely exceeded 500 ha. Pielowski (1972) recovered tagged individuals in areas of about 350 ha, while he concluded from observations of the movements of hares being pursued, that hares are familiar with an area

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